

detecting an operational characteristic of a diaphragm of the speaker based on a voltage applied to the speaker and a current flowing through the speaker;
producing a corresponding detection signal based on said operational characteristic;
integrating the detection signal to generate an amplitude signal; and
positively feeding back the amplitude signal into a driving signal for driving the speaker.

a² cont
16. A speaker driving method according to claim 15, wherein the detection signal is integrated by a low pass filter having a cutoff frequency that is lower than a lowest resonance frequency of the speaker.

17. A speaker driving method according to claim 15, wherein the operational characteristic comprises velocity. *ml*

REMARKS

Claims 1-3 have been examined. Claim 2 has been rejected under 35 U.S.C. § 112, second paragraph, claim 1 has been rejected under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a), and claims 2 and 3 have been rejected under 35 U.S.C. § 103(a).

I. Examiner interview

Applicants' attorney would like to thank Examiner Grier and Primary Examiner Mei for the courtesies extended during the personal interview conducted on September 25, 2001.

II. Rejection under 35 U.S.C. § 112, second paragraph

Claim 2 has been rejected under 35 U.S.C. § 112, second paragraph, because the term “the integrated velocity signal” lacks antecedent basis. Applicants submit that the amendments to the claim overcome the rejection. Furthermore, such amendments do not narrow the scope of the claim.

III. Rejection under 35 U.S.C. § 102(b) over U.P.S. 5,588,065 to Tanaka et al. (“Tanaka”)

Claim 1 has been rejected under 35 U.S.C. § 102(b) as being anticipated by Tanaka. Applicants submit that claim 1 is not anticipated and would not have been obvious over the reference.

For example, claim 1 states that the speaker system detects an amplitude value of a diaphragm of a speaker and produces a corresponding amplitude signal. In addition, the system positively feeds back the amplitude signal into a driving signal. On the other hand, Tanaka does not disclose or suggest such feature. Specifically, as described at column 7, lines 35-67, the disclosed system utilizes a principle of motional feedback (“MFB”), and MFB is based on a principle of conducting negative feedback according to an automatic control theory. Since Tanaka is directed to a negative feedback system, it does not disclose or suggest the invention recited in claim 1.

In addition, although Fig. 1 seems to suggest a circuit in which an adder adds an output from the feed-back circuit 6 to an input signal supplied to the amplifier 4, the circuit actually employs negative feedback instead of positive feedback.

For example, a more detailed description of the feed-back circuit 6 is shown in Fig. 24. As shown in the figure, the circuit 6 includes a gain control section (A) for performing acceleration MFB and a gain control section (B) for performing velocity MFB. The signal input to the acceleration MFB gain control section (A) is supplied via the differential amplifier op2 to the negative input terminal of the differential amplifier op3. Since the positive input terminal of the differential amplifier op3 is connected to ground (via the resistor), the differential amplifier op3 effectively inverts the signal supplied its input terminal. Similarly, in the velocity MFB gain control section (B), the positive input of the differential amplifier op5 is connected to ground, and thus, the differential amplifier op5 effectively inverts the signal supplied its input terminal.

Therefore, the adder shown in Fig. 1 adds inverted signals from the feed-back circuit 6 to the signal supplied to the amplifier 4, and thus, the adder in Fig. 1 performs negative feedback instead of positive feedback. Accordingly, Tanaka actually teaches away from the invention recited in claim 1, and thus, claim 1 is not anticipated or rendered obvious by the reference.

IV. Rejection under 35 U.S.C. § 103(a) over U.S.P. 5,009,280 to Yokoyama ("Yokoyama")

Claim 1 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yokoyama. Applicants submit that claim 1 would not have been obvious over the reference.

For example, as noted above, claim 1 states that the speaker system positively feeds back the amplitude signal into a driving signal. On the other hand, Yokoyama does not disclose such a feature. Specifically, in the embodiment shown in Figs. 7(a), 7(b), and 8, the speaker system comprises a vibrator driver 30 (Fig. 7(a)), and the vibrator driver 30 comprises a motional signal detecting circuit 24 and a subtractor 25 (Fig. 8).

The motional signal detecting circuit 24 receives a signal relating to various factors (i.e. vibrational velocity, acceleration, and displacement) of the of the diaphragm 21 of the speaker (Fig. 7(a)). Then, the circuit 24 detects any one of the various factors and generates a corresponding motional signal S_M . (See, e.g., column 14, lines 12-24). Then, the motional signal S_M is supplied to the subtractor 25, and the subtractor 25 subtracts the signal S_M from the drive signal supplied to the amplifier (not designated) (Figs. 7(a) and 8). (Column 14, lines 24-26). In other words, the vibration driver 30 employs MFB for conducting a negative feedback operation. (Column 13, line 67, to column 14, line 7).

On pages 3 and 4 of the Office Action, the Examiner seems to acknowledge that Yokoyama does not employ positive feedback of a motional signal. However, she maintains that substituting the adder shown in Fig. 4 of the reference in the vibration driver 30 shown in Figs. 7(a) and 8 would have been obvious. Applicants respectfully submit that such a substitution would not have been obvious.

For example, the circuit shown in Fig. 4 is a more detailed illustration of the negative impedance generator 30 shown in Fig. 1(a) and 1(b). (Column 6, line 67, to column 7, line 5; and column 12, lines 47-56). The negative impedance generator 31 is used to decrease and compensate for the impedance inherent in the transducer 22 and does not employ the MFB principle. (Column 7, lines 3-5 and 38-41). In other words, the negative impedance generator 31 detects a current i flowing through a load Z_L to determine the impedance of the load Z_L .

On the other hand, claim 1 relates to positively feeding back an amplitude signal which corresponds to an amplitude value of a speaker diaphragm. Therefore, the use of the negative impedance generator 31 (Fig. 1(a) and 4) is a completely separate and distinct circuit for controlling the speaker system than the motion signal detecting circuit 24 (Fig. 8) which uses the MFB principle. In fact, the specification of Yokoyama treats such structures differently. (See, e.g., column 18, lines 58-68). As a result, one skilled in the art would not have been motivated to substitute the adder in Fig. 4 for the subtractor in Fig. 8 because the Fig. 8 circuit would no longer employ the principle of MFB and would not function appropriately.

In light of the discussion above, Applicants submit that claim 1 is patentable over the reference.

V. Rejection under 35 U.S.C. § 103(a) over Yokoyama in view of U.S.P. 5,815,585 to Klippel ("Klippel") and U.S.P. 5,666,427 to Kim et al. ("Kim")

Claims 2 and 3 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yokoyama in view of Klippel and Kim. Since claims 2 and 3 depend upon claim 1 and since Klippel and Kim do not cure the deficient teachings of Yokoyama with respect to claim 1, Applicants submit that claims 2 and 3 are patentable at least by virtue of their dependency.

Also, Applicants submit that claim 3 is even further patentable over the cited references. For example, claim 3 states that the integrating means comprises a first order low pass filter that has a cutoff frequency that is lower than a lowest resonance frequency f_0 of the speaker. On the other hand, the cited references do not disclose or suggest such a feature.

With respect to Yokoyama, the Examiner acknowledges that it does not explicitly disclose the integrating means. (Office Action, page 4). Therefore, the reference cannot suggest an integrating means that comprises a low pass filter that has a cutoff frequency that is lower than a lowest resonance frequency of the speaker. Also, while Kim and Klippel arguably teach a low pass filter or an integrator, neither reference suggests an integrator comprising a low pass filter having the claimed cutoff frequency. Accordingly, claim 3 is patentable over the Yokoyama, Klippel, and Kim.

VI. Newly added claims

Applicants have added new claims 4-17 to more fully define the present invention. Since claims 5, 8, 11, and 15 contain features that are similar to the features discussed above in conjunction with claim 1, Applicants submit that such claims are patentable for at least the

AMENDMENT UNDER 37 C.F.R. § 1.111
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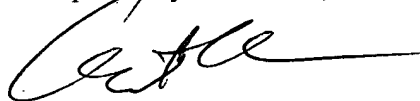
reasons presented above. Also, since claims 4, 6, 7, 9, 10, 12-14, 16, and 17 depend upon claim 3, 5, 8, 11, or 15, Applicants submit that such claims are patentable at least by virtue of their dependency.

VII. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Applicants hereby petition for any extension of time which may be required to maintain the pendency of this case, and any required fee, except for the Issue Fee, for such extension is to be charged to Deposit Account No. 19-4880.

Respectfully submitted,



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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims are amended as follows:

1. (Once amended) A speaker system comprising:

a speaker,

amplitude detecting means for detecting an amplitude value of a diaphragm of the speaker to produce an amplitude signal corresponding to the amplitude value; and

positive feed back [adding] means for positively feeding back [adding] the amplitude signal into a driving signal for driving the speaker.

2. (Once amended) A speaker system according to claim 1, wherein the amplitude detecting means comprises:

velocity detecting means for detecting a velocity of the diaphragm of the speaker to produce a velocity signal; and

integrating means for integrating the [integrated] velocity signal to produce the amplitude signal.